WHAT IS CLAIMED IS:

1. A wheel, comprising:

a peripheral wheel rim;

a central hub with a central axle and an outer flange;

a plurality of spokes extending between the rim and hub, wherein said spokes have a first portion connected to said rim and a second portion opposed to said first portion and connected to said hub;

a cavity formed within at least one of said outer flange and said rim for connection with at least one of said spokes;

wherein at least one of said first portion and said second portion of said spoke is joined to at least one of said outer flange and said rim by means of a deformed engagement in a deformed engagement region; and

wherein said joinder results in a firm connection between said cavity and at least one of said first portion and said second portion of said spoke at said engagement region.

2. A wheel according to claim 1, wherein at least one of said spokes engage said cavity and wherein at least one of said first portion and second portion of said spoke is assembled within said cavity such that at least a portion of at least one of said spoke and said cavity is deformed by means of said

assembly to create said deformed engagement region between said spoke and at least one of said rim and said outer flange.

3. A wheel according to claim 2, wherein said deformed engagement is a gripping and locating engagement which results in an insertion region of overlap between said spoke and said cavity.

4. A wheel according to claim 2, wherein both of said spoke and said outer flange are preformed elements prior to said assembly of said spoke within said cavity.

5. A wheel according to claim 1, wherein at least one of said outer flange and said rim includes a multiplicity of cavities for connection with a multiplicity of spokes by means of said deformed engagement.

6. A wheel according to claim 1, wherein at least two spokes are connected to one of said outer flange and said rim by means of said deformed engagement.

7. A wheel according to claim 1, wherein one end of said spoke has a fixed connection and the opposite end of the spoke

includes means for adjustment of its effective span length, whereby the tension of said spoke may be adjusted.

8. A wheel according to claim 1, wherein said wheel is a tension spoke wheel.

9. A wheel according to claim 1, wherein said cavity is located in said outer flange, and wherein said deformed engagement region provides a firm connection between said spoke and said outer flange.

10. A wheel according to claim 1, wherein said cavity is located in said rim, and wherein said deformed engagement region provides a firm connection between said spoke and said rim.

11. A wheel according to claim 1, wherein said cavity includes two ends with longitudinal sidewalls extending between said two ends and wherein said sidewalls of said cavity are straight.

12. A wheel according to claim 2, wherein said cavity includes at least one open end and closed longitudinal sides, and wherein said cavity surrounds and encloses the cross section of said spoke at said deformed engagement region.

13. A wheel according to claim 12, wherein said cavity is a blind cavity, including one open end, closed longitudinal sides and a closed bottom.

END

14. A wheel according to claim 12, wherein said cavity is a through cavity, including two open ends and closed longitudinal sides.

15. A wheel according to claim 12, wherein said engagement region includes contact between said spoke and said cavity around the full cross-sectional perimeter of said spoke.

16. A wheel according to claim 1, wherein said cavity is an open cavity with an open region along at least a portion of the side of said cavity and at least one open end.

17. A wheel according to claim 16, wherein said cavity only partially surrounds the cross section of the spoke in at least a portion of said engagement region.

18. A wheel according to claim 16, wherein said cavity is curved along its longitudinal axis and wherein said engagement region is a curved engagement region.

19. A wheel according to claim 1, wherein said spoke includes a longitudinal axis in said engagement region and said cavity is a straight cavity with a longitudinal axis and wherein said longitudinal axis of said spoke in said engagement region is colinear with said longitudinal axis of said cavity in said engagement region.

20. A wheel according to claim 19, wherein said spoke includes a generally straight spoke span portion extending between said outer flange and said rim, and wherein said cavity is a straight cavity with a longitudinal axis, and wherein said longitudinal axis of said spoke span portion is aligned to be generally collinear with said longitudinal axis of said cavity.

21. A wheel according to claim 19, wherein said spoke is bent in a region external to said engagement region to direct the span of said spoke to extend to its opposite connection point.

22. A wheel according to claim 21, wherein said longitudinal axis of said cavity is aligned in a generally axial orientation.

23. A wheel according to claim 21, including a spoke guiding portion of at least one of said rim and said outer flange located outside of said cavity, wherein said guiding portion serves to support said spoke in said bent region.

24. A wheel according to claim 23, including an annular supporting element that surrounds said axle, wherein said annular supporting element includes said guiding portion.

25. A wheel according to claim 19, wherein said cavity is a straight cavity with a longitudinal axis and wherein said longitudinal axis is a radially extending axis.

26. A wheel according to claim 19, wherein said cavity is a straight cavity with a longitudinal axis and wherein said longitudinal axis is an obliquely extending axis that is radially offset from the central axial axis of said axle.

27. A wheel according to claim 19, wherein said outer flange includes a multiplicity of said cavities, wherein at least two of said cavities are axially offset from each other.

28. A wheel according to claim 19, wherein said cavity is a through cavity with two open ends and wherein at least two

spokes are engaged with said cavity, with a first spoke extending through a first of said open ends and a second spoke extending through a second of said open ends.

29. A wheel according to claim 19, including at least two cavities, wherein the longitudinal axis of the first cavity is generally parallel to the longitudinal axis of the second cavity and wherein said first cavity is offset from and at least one of radially and axially spaced from said second cavity.

30. A wheel according to claim 1, wherein said spoke is terminated at an end and said end is located within said cavity.

31. A wheel according to claim 1, wherein said spoke is a duplex spoke constituting a continuous element with two structural spans between said rim and said hub, including a common portion engaged to said cavity by means of said engagement region.

32. A wheel according to claim 1, wherein said spoke is a longitudinal element, including a cross-section within said engagement region, wherein said cross-section is a circular cross-section.

33. A wheel according to claim 1, wherein said spoke includes non-circular cross section geometry within said engagement region which serves to limit twisting of said spoke about the longitudinal axis of said cavity.

34. A wheel according to claim 33, wherein said cross-section is a generally flat cross-section with a width greater than its thickness.

35. A wheel according to claim 1, wherein said spoke has a spoke span portion extending between said outer flange and said rim and wherein said spoke span portion has a generally flat cross-section with a width greater than its thickness and wherein said width is oriented in a generally tangential direction for reduced aerodynamic resistance in the direction of wheel rotation.

36. A wheel according to claim 9, wherein said outer flange includes at least first and second of said engagement regions, each associated with separate spokes, and wherein said first engagement region is a longitudinal engagement region, including a portion thereof of close proximity and reduced material thickness to a portion of said second engagement region.

37. A wheel according to claim 36, wherein at least one of said cavities is a straight cavity with a longitudinal axis and wherein said longitudinal axis is an obliquely extending axis.

38. A wheel according to claim 36, including an overlap region as viewed in the axial plan view, wherein said portion of close proximity includes said overlap region.

39. A wheel according to claim 38, wherein said overlap region includes an angle of overlap, and wherein said angle of overlap, as measured radially outwardly from said overlap region in the plan view, is less than 180 degrees.

40. A wheel according to claim 38, wherein said overlap region includes an angle of overlap, wherein said angle of overlap, as measured radially outwardly from said overlap region in the plan view, is greater than or equal to 180 degrees.

41. A wheel according to claim 38, wherein the longitudinal engagement region of said first spoke includes at least two overlap regions associated with the longitudinal engagement region of at least one other of said spokes, wherein said longitudinal engagement region of said first spoke serves as a reinforcing span to bridge between said overlap regions.

42. A wheel according to claim 41, including at least two of said reinforcing spans, wherein said reinforcing spans are interconnected by means of at least one overlap region to provide a full circumference of said reinforcing spans to provide hoop strength reinforcement of said outer flange about its axial axis.

43. A wheel according to claim 36, wherein said spokes contact each other in said region of close proximity.

44. A wheel according to claim 1, wherein said outer flange includes a multiplicity of clockwise-radiating oblique spokes and a multiplicity of counterclockwise radiating oblique spokes, wherein at least one of said clockwise spokes is axially offset from at least one counterclockwise spoke.

45. A wheel according to claim 1, wherein said cavity includes two ends with sidewalls extending between said two ends, and wherein said deformed engagement region occurs in at least a portion of the sidewalls of said cavity.

46. A wheel according to claim 1, wherein said cavity is a longitudinal cavity with a cross-sectional dimension and wherein

said spoke has a cross-section dimension within said engagement region corresponding to said cavity cross-sectional dimension, wherein said cross sectional dimension of said spoke is larger than the corresponding cross-section dimension of said cavity such that an interference fit between said spoke and said cavity is created, resulting in said deformed engagement region.

47. A wheel according to claim 1, wherein said spoke has a cross-sectional thickness in said engagement region and wherein said engagement region is a longitudinal engagement region including a longitudinal depth of engagement that is greater than said cross-sectional thickness.

48. A wheel according to claim 47, wherein the depth of engagement between spoke and cavity is at least 2 times the cross sectional thickness of the spoke.

49. A wheel according to claim 1, wherein greater than one of said spokes are engaged within a single of said cavity.

50. A wheel according to claim 1, wherein one of said spokes is engaged within a single of said cavity.

51. A wheel according to claim 1, wherein said cavity has an end portion that is at least partially closed and wherein said spoke is terminated at an end with said end located within said cavity, wherein said spoke end portion contacts said cavity end.

52. A wheel according to claim 1, wherein said spoke includes a configured surface in said engagement region and said cavity at least partially conforms to said configured surface upon said joining.

53. A wheel according to claim 52, wherein said configured surface includes helical threads to create said deformation of said cavity and wherein said engagement is a threaded engagement, wherein said spoke is threadably assembled to said cavity.

54. A wheel according to claim 52, wherein said configured surface includes annular ribs to create said deformation of said cavity.

55. A wheel according to claim 52, wherein said configured surface includes at least one raked edge to create said deformation of said cavity, wherein said edge is raked in a direction to provide a ramped surface for reduced spoke

insertion force and a sharp edge for increased spoke pull-out force.

56. A wheel according to claim 1, wherein said cavity includes a configured surface in said engagement region and said spoke at least partially conforms to said configured surface of said cavity upon said joining.

57. A wheel according to claim 1, wherein said spoke is inserted to be engaged within said cavity, and wherein said cavity has a longitudinal axis, and wherein the direction of said insertion is a longitudinal insertion along the longitudinal axis of said cavity.

58. A wheel according to claim 1, wherein said cavity is an open cavity with at least one open side and wherein said spoke is assembled into said cavity in a generally axial direction perpendicular to the axis of said cavity.

59. A wheel according to claim 1, wherein said cavity is an open cavity with at least one open side and wherein said spoke is inserted into said cavity in a generally radial direction.

60. A wheel according to claim 1, including an auxiliary engaging member, wherein said engaging member is engaged with both said spoke and at least one of said rim and said outer flange, wherein said engaging member serves as a secondary fastening means to augment said firm connection.

61. A wheel according to claim 1, wherein said spoke may be subsequently disassembled from said flange without damaging said flange and wherein said spoke may be reassembled to said flange after said disassembly.

62. A wheel according to claim 1, wherein, upon said joining, said spoke is permanently assembled to said outer flange such that disassembly of said spoke from said flange damages at least one of said spoke and said outer flange, thereby precluding subsequent reassembly of said spoke to said flange.

63. A wheel according to claim 1, wherein said cavity is a through cavity with two open ends and wherein said spoke is a duplex spoke constituting a continuous element with two structural spans between said rim and said hub, including a common portion engaged to said cavity by means of said deformed engagement, with a first structural span extending through a

first open end and a second structural span extending through a second open end.

64. A wheel according to claim 1, including a first spoke and a second spoke engaged within a common cavity, wherein said first spoke is engaged with said second spoke.

65. A wheel according to claim 1, including a longitudinal connecting interface between said second portion of at least one of said spokes and said outer flange, wherein, as viewed in the plan view, said second portion of said spoke extends within said cavity to pass beyond an imaginary line radial to an axial central bore of said central hub and perpendicular to a longitudinal axis of said spoke.

66. A wheel according to claim 1, including a configured portion of at least one of said cavity and said spoke which includes a retractable engagement surface such that said retractable engagement surface may passively deform and retract during said joining and extend upon completion of said joining to interlock with a mating surface of the respective one of said cavity and said spoke for a firm assembled connection between said spoke and said cavity.

67. A wheel according to claim 1, where said deformed engagement constitutes cold flow, wherein at least one of said spoke and said cavity undergoes said deformed engagement without appreciable softening due to the application of heat.

68. A wheel according to claim 1, including a clamping member, wherein said cavity is an open cavity, and wherein said clamping member is operative to force said spoke into intimate contact with said cavity to create said deformed engagement between said outer flange and said spoke.

69. A wheel according to claim 68, wherein at least one of said clamping member and said outer flange includes said cavity, and wherein at least one of said cavity and said spoke include a configured surface in said engagement region such that at least one of said spoke and said cavity is conformed to said configured surface, resulting in said deformed engagement region for a firm connection between said spoke and said cavity.

70. A wheel according to claim 1, including a joining member, wherein said joining member includes at least one cavity, and wherein at least two of said spokes are engaged to said joining member at said deformed engagement region, and

wherein said joining member is connected to one of said rim and said outer flange.

71. A wheel according to claim 70, wherein said joining member is an annular element, including a central opening to surround said central axle.

72. A wheel according to claim 1, wherein said spoke is directly engaged with said cavity.

73. A wheel according to claim 1, including an intermediate connecting member, wherein at least one of said spokes is connected to said intermediate connecting member, and wherein said intermediate connecting member is engaged to said cavity by means of said deformed engagement region.

74. A wheel according to claim 73, wherein at least two of said spokes are connected to a singular intermediate connecting member.

75. A wheel according to claim 73, wherein said intermediate connecting member is a collar that surrounds the cross-section of said spoke.

76. A wheel according to claim 1, including at least one reinforcement element connected to at least one of said rim and said outer flange, wherein said reinforcement element serves to reinforce at least one of said rim and said outer flange to resist stress and deflection associated with spoke tensile forces.

77. A wheel according to claim 76, wherein said reinforcement element is connected to said outer flange and is a continuous annular element, including a central opening to surround said axle and wherein said reinforcement element provides radial and hoop stresses reinforcement to at least one of said rim and said outer flange.

78. A wheel according to claim 76, wherein said spoke is positioned to contact said reinforcement element.

79. A wheel according to claim 1, wherein the material of said cavity is a polymeric material.

80. A wheel according to claim 79, wherein said polymeric material includes reinforcement fibers.

81. A wheel according to claim 1, including differential hardness between the material of said cavity and the material of said spoke in said deformed engagement region, wherein at least one of said spoke and said cavity is softer than the mating spoke or cavity.

82. A wheel according to claim 9, wherein said outer flange includes a raised external geometry to locally increase flange thickness to support said spoke in said deformed engagement region.

83. A wheel according to claim 9, wherein said outer flange includes recessed external geometry.

84. A wheel according to claim 82, including a through opening within said flange, wherein said flange extends to surround said through opening.

85. A wheel according to claim 9, wherein said outer flange includes raised external geometry to provide for increased depth of said engagement region with said spoke.

86. A wheel according to claim 9, including a hub shell, wherein said hub shell includes at least two axially separated

outer flanges for connection with said second portion of said spoke and including a spacer portion therebetween.

87. A wheel according to claim 86, wherein said at least two outer flanges and said spacer portion are formed as a single contiguous unit.

88. A wheel according to claim 86, wherein said outer flanges include a first and second outer flange, and wherein said first outer flange is joined to said second outer flange at a joining interface.

89. A wheel according to claim 88, including a spacer element axially separating said first outer flange and said second outer flange, wherein said first outer flange is joined to said spacer element at a first joining interface and said second outer flange is joined to said spacer element at a second joining interface.

90. A wheel according to claim 88, wherein at least one of said first outer flange and said second outer flange includes an integral spacer portion to axially separate said first outer flange from said second outer flange, and wherein at least one

of said first outer flange and said second outer flange is joined to said spacer portion at a joining interface.

91. A wheel according to claim 88, wherein said joining interface is a rotatably keyed joining interface such that said outer flanges are locked to maintain angular orientation between said first outer flange and said second outer flange.

92. A wheel according to claim 88, wherein said joining interface is a detachable joining interface that may be detached and reattached, including means to fasten said first outer flange to said second outer flange.

93. A wheel, comprising:

a peripheral wheel rim;

a central hub with an axle and an outer flange;

a plurality of spokes extending between the rim and hub, wherein said spokes have a first portion connected to said rim and a second portion opposed to said first portion and connected to said hub;

a cavity formed within said outer flange for engagement with the second portion of at least one of said spokes;

wherein said second portion of said spoke is joined to said cavity to create an engagement region between said spoke and said outer flange;

wherein said spoke has a cross-sectional thickness in said engagement region, and wherein said engagement region is a longitudinal engagement region including a longitudinal depth of engagement that is greater than said cross-sectional thickness;

wherein said spoke includes configured geometry to engage said cavity and said cavity includes configured geometry to engage said spoke at said engagement region;

wherein said engagement region includes longitudinally spaced engagement sites;

wherein said engagement results in a firm connection between said outer flange and said second portion of said spoke at said engagement region; and

wherein at least a portion of said outer flange in said engagement region is constructed of polymeric material.

94. A wheel according to claim 93, wherein said engagement region occurs along at least a portion of the sidewall of said cavity.

95. A wheel according to claim 93, wherein the second portions of at least two of said spokes are engaged with one outer flange.

96. A wheel according to claim 93, wherein said configured geometry of said spoke is a helical male thread, and wherein said configured geometry of said cavity is a helical female thread, including a threaded engagement between said spoke and said outer flange in said engagement region.

97. A wheel according to claim 93, wherein said cavity is an open cavity that is open along at least a portion of the side of said cavity and wherein said spoke is assembled to said open cavity in a direction perpendicular to the longitudinal axis of said cavity.

98. A wheel according to claim 93, wherein said configured geometry of said spoke is preformed, and said configured geometry of said cavity is preformed, and wherein said spoke is assembled to said cavity such that said configured geometry of said spoke is interlocked with said configured geometry of said cavity.

99. A wheel according to claim 1, wherein at least a portion of said cavity includes a molding material adjoining thereto, wherein said molding material has a softened, conformable state and a subsequent hardened state, such that upon said joining of said spoke to said cavity during said softened state, said softened molding material is deformed to conform to at least one of said spoke and said cavity in said deformed engagement region, and wherein conversion of said molding material from said softened state to said hardened state creates said firm connection between said spoke and at least one of said rim and said outer flange.

100. A wheel according to claim 99, wherein said hardened molding material is adhered to at least one of said cavity and said spoke at said deformed engagement region.

101. A wheel according to claim 99, wherein at least one of said spoke and said cavity includes an undercut in said engagement region, and wherein said molding material is conformed to said undercut in its softened state such that, upon hardening, said molding material becomes engaged to said undercut to provide resistance to separation forces between said spoke and said cavity.

102. A wheel according to claim 99, wherein spoke is of multi-filament construction including a bundle of individual filaments, and wherein said filaments are split, splayed or bifurcated within said deformed engagement region to provide increased surface area of interface between said spoke and molding material.

103. A wheel according to claim 99, wherein said outer flange includes at least one open cavity with an open sidewall portion, wherein said open cavity includes said hardened molding material with at least one spoke engaged to said molding material.

104. A wheel according to claim 103, including a central axle, wherein said open cavity at least partially circumscribes said axle and wherein said spoke at least partially circumscribes said axle in said engagement region.

105. A wheel according to claim 103, including a cover enclosing at least a portion of said open sidewall of said of said open cavity.

106. A wheel according to claim 1, wherein at least a portion of the material surrounding said cavity has a softened,

conformable state to facilitate said deformed engagement and a subsequent hardened state, and wherein said softened state occurs in a localized region adjoining and including said deformed engagement region such that upon said joining of said spoke to said cavity during said softened state, said softened material is deformed to conform to said spoke at said deformed engagement region, and wherein conversion of said material from said softened state to said hardened state creates said firm connection between said cavity and said spoke.

107. A wheel according to claim 106, including an interference fit between said spoke and said cavity.

108. A wheel according to claim 106, wherein said softened state is achieved through the application of mechanical energy at the interface between said spoke and said cavity in said deformed engagement region.

109. A wheel according to claim 106, wherein said softened state is achieved through thermal energy transfer, wherein said thermal energy is transferred between said spoke and said cavity in said engagement region.

110. A wheel according to claim 106, wherein said temporarily softened state is achieved through the chemical softening of at least one of said spoke and said cavity.

111 ~~112~~. A wheel according to claim 106, wherein said spoke pierces at least one of said rim and outer flange to simultaneously form said cavity and said deformed engagement region.

112 ~~113~~. A wheel according to claim 106, wherein said spoke has a softened, conformable state and a hardened state in said engagement region and wherein the material of said spoke and said material surrounding said cavity are simultaneously softened such that the material of said spoke is fused and welded to the said material surrounding said cavity, and wherein conversion of the material of said spoke and said cavity material from said softened state to said hardened state creates said firm connection between at least one of said rim and said outer flange and said spoke.